



# Piloting inclusive aquafeed business models: Experiences and outcomes in Zambia



Funded by



# Piloting inclusive aquafeed business models: Experiences and outcomes in Zambia

---

## Authors

Catherine Mawia Mwema, Netsayi Noris Mudege and Victor Siamudaala.

## Citation

This publication should be cited as: Mwema CM, Mudege NN and Siamudaala V. 2022. Piloting inclusive aquafeed business models: Experiences and outcomes in Zambia. Penang, Malaysia: WorldFish. Program Report: 2022-27.

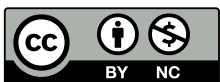
## Acknowledgments

This report was undertaken as part of the CGIAR Research Initiative on Resilient Aquatic Food Systems for Healthy People and Planet and funded by [CGIAR Trust Fund](#). Funding for this work was provided by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in the framework of the Piloting Inclusive Business and Entrepreneurial Models for Smallholder Fish Farmers and Poor Value Chain Actors in Zambia and Malawi project. The authors would like to acknowledge the contributions by WorldFish staff in Zambia for their efforts during implementation of the activities. Special thanks to Dr. Mary Lundeba and Mercy Sichone. The authors are grateful to the pilot study participants for their time and commitment. We acknowledge the partnership and collaboration from the Department of Fisheries, Zambia, and the private sector, particularly the feed companies (Aller Aqua and Novatek).

## Contact

WorldFish Communications and Marketing Department, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia. Email: [worldfishcenter@cgiar.org](mailto:worldfishcenter@cgiar.org)

## Creative Commons License



Content in this publication is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License ([CC BY-NC 4.0](#)), which permits non-commercial use, including reproduction, adaptation and distribution of the publication provided the original work is properly cited.

© 2022 WorldFish.

## Photo credits

Front cover, pages 10, 21, 26, Catherine Mwema/WorldFish; pages 6, 12, 19, Agness Chileya/WorldFish.

# Table of contents

---

List of abbreviations	1
Executive summary	2
Introduction	3
Context	3
Inclusive business models	4
1. Data and methods	7
2. Design of the business models	8
Selected business enterprises	8
3. Implementing the business models	11
Financing	11
Training, mentorship and coaching	11
Innovation platform	11
Gender and youth inclusion	12
4. Performance assessment	13
Financial outcomes	13
Sales and revenues	13
Profitability	14
Market reach	15
Farmer training	16
5. Discussion	18
Market reach and financial outcomes	18
Training	18
6. Sustainability	20
Supply chain gaps	20
Capital investment	20
Feed demand	20
7. Perception and feedback	22
8. Lessons and recommendations	25
Notes	27
References	27
List of figures	29
List of tables	29
Annex 1. Assessment tool for feed operators	30

# List of abbreviations

---

BMPs	better management practices
DOF	Department of Fisheries
FAO	Food and Agriculture Organization
IBEMs	inclusive business and entrepreneurial models
NGO	nongovernmental organization
SMEs	small and medium enterprises
TOT	training of trainers
ZAEDP	Zambia Aquaculture Enterprise Development Project
ZANACO	Zambia National Commercial Bank
ZMW	Zambian Kwacha

# Executive summary

---

In Zambia, most smallholder fish farmers are located in regions with poor access to productive inputs, particularly in Northern and Luapula provinces. To buy high-quality fish feed, farmers in these provinces have to travel long distances, so most of them instead use incomplete fish feeds, which leads to low fish productivity. This reveals the glaring need to establish last-mile business models that would provide these farmers with access to high-quality inputs.

To address this need, the Piloting Inclusive Business and Entrepreneurial Models for Smallholder Fish Farmers and Poor Value Chain Actors in Zambia and Malawi project, funded by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, aimed to pilot and establish inclusive business models to improve access to input and output markets, extension and knowledge for smallholder farmers.

This report shares the experiences and outcomes in piloting three last-mile inclusive aquafeed business models to supply fish feed and knowledge to smallholder farmers in Zambia.

This report has five objectives:

1. Describe the design and implementation of the business models.
2. Assess the financial outcomes
3. Assess the outcomes from the farmer training.
4. Evaluate gender and youth inclusion.
5. Assess the sustainability of the business models.

To assess the performance of the business models, this paper uses both quantitative and qualitative data collected from March 2021 to March 2022.

The project set up business models with three types of enterprises: (1) agro-shops, (2) cooperatives and (3) small-scale farms. It supplied them with 30 t of fish feed worth ZMW 450,533 (USD 25,863), of which the project paid 70% of the cost to lower the risk of the startup investment. In the same year, the enterprises sold 98.8% of the feed at market prices, and they were trained and encouraged to reinvest any profits back into their fish feed business. Independently, some of the enterprises bought an additional 27.7 t of feed. Overall, the enterprises sold feed to 403 fish farmers and trained 585 on aquaculture better management practices (BMPs) and aquapreneurship.

All three business models were profitable, reporting positive margins ranging from 7.5% to 8.5%. The agro-shops reported the highest margin (8.5%) from high volumes of feed sold. While the agro-shops sold fish feed to more farmers than the other business models, the cooperatives trained more farmers. Comparatively, the cooperative model offered a greater opportunity to include women and youths, while the agro-shops demonstrated higher levels of business sustainability.

For the cooperatives, commitment to business objectives among leaders and members is key to business sustainability.

We find business mentorship and coaching integral to the financial sustainability of the business models, so it is necessary to mainstream it in inclusive business development. Co-financing approaches are important in helping enterprises test new inclusive business models.

# Introduction

---

This paper shares experiences and outcomes in piloting aquafeed business models in Zambia under the Piloting Inclusive Business and Entrepreneurial Models for Smallholder Fish Farmers and Poor Value Chain Actors in Zambia and Malawi project funded by Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH. This project intended to pilot and expand inclusive business models to improve the access of smallholder fish farmers to productivity-enhancing quality fish seed, fish feed and innovative training. The goal was to improve incomes and to get more women and youths involved in aquaculture and to benefit from it. The project also aimed to increase fish consumption to improve healthy and nutritious diets at scale. The project established 10 feed businesses and 30 seed businesses in Zambia's Northern and Luapula provinces with the aim of reaching nearly 3000 farmers with seed and feed and to boost their knowledge of both.

The project had the following outputs:

- Output 1: Establish inclusive business and entrepreneurial models (IBEMs) and make them functional for piloting to service local smallholder farmers.
- Output 2: Establish innovation platforms with private and public actors and make them functional.
- Output 3: Create innovative training materials on BMPs, business skills development, and entrepreneurship.
- Output 4: Assess and evaluate the efficacy of the IBEMs, innovation platforms, and training materials and approaches.

The project aimed to address key challenges facing smallholder aquaculture farmers in Zambia and Malawi. First, smallholders rely on poor-quality recycled seed, either saved from their stock or sourced from fellow farmers. Second, although there are aquafeed companies in Zambia, their ability to supply feed to smallholders, especially in rural areas, is limited. Third, extension services are almost exclusively provided by the public sector, so smallholders do not adequately receive support from public sector extension officers because of human and financial resource constraints. A lack of understanding of how to engage with smallholder farmers coupled with doubts about the profitability of the smallholder sector prevents private sector players from investing in the sector.

This paper focuses on aquafeed business models implemented in Zambia and aims to explore five areas: design of the business models, financial performance, performance of farmer training, gender and youth inclusion, and sustainability. It also shares the benefits that the entrepreneurs said they accrued in piloting the inclusive aquafeed business models. Section 1.1 describes what inclusive business models are and provides context for the aquaculture sector in Zambia.

## Context

Over the past decade, Zambia has experienced unprecedented growth in aquaculture production (Kaminski et al. 2018). In 2021, production increased 30% from 45,670 t in 2020 (DOF 2022). However, per capita fish consumption in the country still outstrips supply. In 2014, average consumption stood at 10.4 kg and was projected to increase to 13.3 kg by 2030 (Tran et al. 2018). Currently, the fish supply deficit is supplemented by fish imports from Namibia, China, South Africa and Poland. With imports estimated at 92,168 t in 2021 (DOF 2022), there is a need for expanded aquaculture production to meet growing consumer demand.

Tilapia species dominate Zambian aquaculture production, which consists of both commercial firms and smallholder farmers. The Department of Fisheries (DOF) (2018) estimated that 9615 smallholders and 126 commercial establishments were engaged in fish farming in 2017, with commercial establishments producing 15,997 t (74%) of fish and smallholder farmers just 5570 t. The majority of smallholders operate earthen ponds.

Several factors contribute to the low productivity of smallholder fish farms, including a lack of access to quality inputs and knowledge (Kaminski et al. 2018; Kakwasha et al. 2021; Lundeba et al. 2021) as well as poor management practices (Lundeba et al. 2022). Lack of access to finance and extension services can also explain why smallholder fish farmers are unproductive. Value chain upgrading through vertical and horizontal coordination can facilitate better access to input and output markets (Kaminski et al. 2018).

Zambia has the most established commercial fish feed manufacturers in the Southern Africa Development Community, stimulated by the growth of commercial fisheries and hatcheries. Commercial feed millers in Zambia are located mainly in Lusaka and Southern provinces. In Southern Province, Siavonga District alone has two international commercial feed millers supplying the many commercial fish farms on Lake Kariba (Mwema et al. 2021a). Yet, despite the presence of commercial feed producers in Zambia, access to fish feed among smallholders remains a challenge. Kakwasha et al. (2020) estimated that only 19% of smallholders used commercial feed in Northern and Luapula provinces.

Smallholders find it challenging to travel close to 200 km, which is how far some have to go to buy fish feed. Since many smallholders prefer to buy feed in small quantities, the high cost of transportation makes it uneconomical to do so. Because of this, the current business model in fish feed distribution, which sets up outlets in urban centers far from smallholder fish farmers, makes it difficult for smallholder fish farmers to access high-quality fish feed. As such, it is essential to set up last-mile feed distributors to bridge the access gap for smallholder farmers and bring feed closer to them.

Recently, the Government of Zambia has begun to invest in the development of smallholder aquaculture. The Zambia Aquaculture Enterprise Development Project (ZAEDP) was implemented with the aim of developing a domestic aquaculture subsector by enhancing production and productivity to improve the livelihoods of men and women beneficiaries along the aquaculture value chain. The USD 50 million project was funded by the Government of Zambia and the African Development Bank. The ZAEDP was similarly implemented through bilateral collaboration with not-for-profit organizations like WorldFish and covered some districts in the Northern region of Zambia.

Another government initiative is the Citizens Economic Empowerment Commission (CEEC), a body mandated to promote broad and equitable economic empowerment among citizens with limited access to economic resources and development capacity. The commission provides affordable financing to various farm and non-farm enterprises, including smallholder actors in aquaculture. In Northern and Luapula provinces, the CEEC appointed small and medium enterprises (SMEs) to supply prefinanced aquaculture inputs to smallholder farmers who are recipients of CEEC funds.

## **Inclusive business models**

A business model describes the rationale of how an organization creates, delivers and captures value (Osterwalder 2006). Inclusive business models are pro-poor, equitable and profitable business activities that integrate poor smallholders, processors, retailers, distributors and consumers in the value chain while generating broader positive development outcomes (Vorley et al. 2009; GIZ 2013).

According to Vorley et al. (2009), business models in small agriculture can be producer-driven, buyer-driven or driven by intermediaries, as shown in Table 1.

Type	Drivers	Objectives
Producer-driven	Small-scale producers	New markets Higher market price Stabilized market position
	Large farms	Extra supply volumes
Buyer-driven	Processors, exporters and supermarkets	Supply assured
Intermediary-driven	Traders, wholesalers and other traditional market actors	Supply more discerning customers
	Nongovernmental organizations (NGOs) and other support agencies	“Make markets work for the poor”
	National and local governments	Regional development

Source: Adapted from Vorley et al. 2009.

**Table 1.** Typical organization of smallholder production.

Producer-driven models are driven by producers such as cooperatives and farmer-owned businesses, while buyer-driven models involve larger businesses that organize farmers into suppliers and potentially provide inputs and technical advice. Producer-driven models through cooperatives can provide members with economic benefits in terms of access to dynamic markets and establishing economies of scale in access to input and output markets through aggregation. However, cooperatives face challenges related to group dynamics, governance, financial constraints and conflicting interests, which can ultimately affect their sustainability (Vorley et al. 2009; Orr and Mwema 2013). Nevertheless, technical assistance in cooperative development can surmount some of these challenges (FAO 2015).

Outgrower schemes through contract farming and franchise models are the most common buyer-driven models initiated by processors, supermarkets and exporters. Contract farming and franchises offer price advantages and a reliable market to small-scale farmers. However, these models face contractual enforcement challenges and can be associated with costs related to compliance and certification, which pose challenges to smallholder inclusion (Barret et al. 2012; Orr et al. 2013; Mwema and Crewett 2019).

Intermediary models driven by traders offer closer links to buyers, which reduce investment risks and transaction costs. The key challenge, however, is the profit-maximizing nature and tendency to extract windfall profits from small-scale producers (Vorley et al. 2009). Traders might have little incentive to invest in inclusive approaches, which could exclude smallholders and vulnerable groups. As such, there is a need for public initiatives to promote social inclusion (GIZ 2013; FAO 2015).

To make markets work for the poor, the public sector, NGOs and other support agencies could be the ones to drive business models. Nonprofit organizations, especially, have played an important role in driving business models for smallholder inclusion (Orr and Mwema 2013). The setbacks faced in most business models driven by the public sector and NGOs relate to sustainability challenges from limited ownership of the models among value chain actors. Models driven solely by NGOs or the public sector with little or no private sector involvement can result in poorly coordinated markets (FAO 2015). Despite these challenges, NGO-driven models have been effective when they have a strong and clear business development focus, with timelines and a strategy to cease external support (FAO 2015).



A review of the aquafeed business models used for Asia and Africa show that various models have been applied in the production, distribution and retailing of fish feed (Mwema et al. 2021a). In Africa, cooperatives have been used across different countries to generate a critical mass of feed suppliers to promote competitive prices for commercial fish feed and boost the local feed production (Ha et al. 2013; El-Sayed et al. 2014; Hyuya et al. 2017). In Egypt, for instance, cooperatives buy feed in bulk for their members at a discount from both state-owned and private millers (El-Sayed 2014). In Kenya, facilitated by NGOs, local aquashops provide quality inputs and training to smallholder tilapia farmers (Obwanga and Lewo 2017). Small cottage industries have also been a source of fish feed for smallholders. However, studies in Bangladesh, Nigeria and Kenya have shown that, more often than not, these produce low-quality fish feed because of a lack of knowledge on feed formulations and the inability to access feed ingredients year-round (Mamun Ur-Rashid et al. 2013; Munguti et al. 2014).



Photo credit: Agness Chilega/WorldFish

A farmer feeding fish in Luapula, Zambia.

# 1. Data and methods

Piloting the inclusive business models was anchored on action research. This is a methodological approach for collaborative research with practitioners and community partners to inform practice, community development and policy, while contributing to the scientific knowledge base (Sankaran et al. 2001; Shani and Coghlan 2021). Action research entails an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action or intervention, and reflective learning (Sankaran et al. 2001; Badburry et al. 2013). The researchers piloted

the inclusive business models in collaboration with the DOF, the private sector and the selected enterprises.

This paper draws from quantitative and qualitative data collected over one year, from March 2021 to March 2021, during the implementation of the business models. Tools were developed to collect periodic data on sales, clients reached and farmers trained by the enterprises.

Table 2 presents a summary of the data sources used to address the paper's objectives.

Objective	Data sources and type
Design and implementation of business models	Literature review, scoping study, stakeholder workshop, assessment data, mentorship, coaching reports
Financial performance	Sales monitoring data (volumes, product type, prices, clients), cost of operation data
Farmers trained	Training monitoring data (farmers trained, sex, age)
Gender and youth inclusion	Assessment data, monitoring data on sales and clients, training data on farmers
Perceived benefits by entrepreneurs	Qualitative inquiries, structured questionnaire

**Table 2.** Data sources used in the study.

## 2. Design of the business models

Figure 1 presents a summary of how the business models and enterprises were identified and selected.

**Step 1:** The first step entailed a review of aquafeed business models applied in Asia and Africa to draw lessons and recommend potential business models for Zambia and Malawi (Mwema et al. 2021a). The review also highlighted the key strengths and weaknesses of the various business models.

**Step 2:** A scoping study was undertaken to draw lessons and experiences on implementing the cooperative model and other aquafeed business models (Mwema et al. 2021b). Drawing from the literature review and scoping study, three business models were identified as feasible for piloting the distribution and marketing of commercial fish feed, as well as offering technical training to farmers. These included retailing by agro-shops, retailing by small-scale farms (referred to as individual farmers by the project), and aggregation and retailing by cooperatives.

**Step 3:** The pilot also conducted participatory validation and adaptation of business models with stakeholders. Stakeholders from academia, civil society, and the public and private sectors were invited to participate in adapting the models to meet the needs of smallholder aquaculture in Zambia (Mudege and Mwema 2021).

**Step 4:** Potential enterprises were assessed to test the business models. The assessment was done using a tool developed to collect data on key selection criteria, including geospatial location, financial ability, interest and commitment to aquaculture development, and gender considerations (Annex 1). A total of 16 potential enterprises were assessed.

### Selected business enterprises

Table 3 summarizes the description of the 10 enterprises<sup>1</sup> selected to test the business models: five agro-shops, two cooperatives and three small-scale farms. The selected enterprises had never sold fish feed before, and they were located in various districts in Northern and Luapula provinces to serve smallholder farmers who had no access to fish feed.<sup>2</sup>

All the enterprises had operated for at least 3 years. Of the five agro-shops, three were agro-inputs dealers and two were fish off-takers. Most of the agro-shops operated other business lines and owned the business premises they operated from. Among the two cooperatives, one was dominated by female farmers and the other by youths. Combined, the cooperatives had 16 ponds, eight apiece, and each owned the premises they operated from. As for the three small-scale farms, each operated at least five fishponds, and owned the ponds and land they operated from.



**Figure 1.** Steps in the design and selection of the business models.

Business model	Case name	Brief description
Aggregation by cooperatives	Cooperative 1	This cooperative, which started operations in 2016, manages tilapia and catfish fingerling hatcheries. It has 11 fishponds, at an average size of 20 m x 20 m. The cooperative also engages in agriculture, including the production of broilers and indigenous chickens, day-old chicks, poultry egg production and fruit farming. It has 24 members, 20 of whom are women, and has six youths employed to work on the farm.
	Cooperative 2	This cooperative started fish farming in 2017 with two ponds and now has eight ponds of varying sizes, most of which are 20 m x 20 m. The main activity of the cooperative is producing table-size fish. It is a new cooperative, with 28 members below the age of 35. Besides fish farming, the cooperative also engages in crop farming, mainly maize.
Retailing by small-scale farms	Farm 1	This is an aquaculture farm that produces fingerlings and table-size fish. The farm, which started operations in 2016, is family-managed by a male and female head. It currently operates eight 20 m x 20 m ponds and an integrated crop-livestock farming system of chickens, agroforestry and crops. The owner underwent hands-on aquaculture training under the ZAEDP project.
	Farm 2	A male and female head manage this fish farm. They have been doing aquaculture since 2016 and currently manage eight ponds, including six that are 20 m x 20 m and two that are 10 m x 10 m, as well as two fingerling hatcheries. The family also grows crops and keeps pigs and poultry. Besides farming, the owner runs a hardware business that sells construction materials.
	Farm 3	This fish farm is managed by a male and female head and their children. They operate 10 ponds in total and have been doing aquaculture farming since 2014. The owner is a lead farmer under the Farmers Input Support Program.
Retailing by agro-shops	Agro-shop 1	This family-owned agro-shop is managed by a male and female head and their daughter. The shop has existed since 2016 and sells agricultural products like fertilizers, certified seeds and veterinary drugs. The business works out of a rented shop.
	Agro-shop 2	This is a family-owned agro-shop managed by a couple, their two sons and one daughter. The business has been in operation since 2000 and deals with agro-input supplies like seeds, fertilizers, agrochemicals, poultry feed, and the sale of day-old chicks. It also runs an agency banking business for Zambia National Commercial Bank (ZANACO). The family owns and operates the shop and has two male youths employed.
	Agro-shop 3	This family-owned agro-shop is managed by a male and female head, and three young employees. The business has existed since 2008 and deals in agro-inputs, mechanization, solar products and water pumps. It has been contracted by a brewery as an off-taker of cassava, and it also offers services in transporting goods using a truck. All the operations are managed in a single leased premises.
	Agro-shop 4	This business started operations in 2000 and is managed by a male head and five youth employees. It buys fish from small-scale farmers, using motorbikes and a van, and sells them to consumers and traders. The business operates a mini supermarket, which is also used as a fish selling point. At the supermarket, the business operates an agency that banks through ZANACO. The owner also manages a restaurant and hotel business from the same premises he owns.
	Agro-shop 5	This is a female-owned and managed agro-shop that mainly buys and sells fish. The business also sells other meat products like sausages, pork, beef and cold drinks. The enterprise has been in existence since 2016 and operates out of a rented shop. The owner also works with farmers as an extension officer.

**Table 3.** Description of the business models and business cases piloted.

The cooperatives and small-scale farms operated from their farms, selling feed directly on-farm to limit operating costs. The cooperative model entailed buying feed to use in the cooperative ponds and selling to both members and non-members. Members farmed fish on the cooperative ponds as well as their individual ponds. The small-scale farm owners would buy feed to use on their farms and sell fish feed directly to other nearby farmers. The agro-shops would buy feed and sell it directly from their existing business premises. They would share the overhead costs across other business enterprises they operate on their business premises.



Photo credit: Catherine Mwenya/WorldFish

An entrepreneur selling feed at his outlet in Luwingu District, Zambia.

## 3. Implementing the business models

### Financing

To de-risk the startup investment by entrepreneurs while forging sustainability and ownership of the three business models, the models incorporated a co-financing grant toward purchasing two consignments of startup fish feed. The feed was bought from manufacturers in March and November 2021. The project covered 70% of the feed cost, while the enterprises paid the remaining 30%. The enterprises also covered the businesses' operational costs and purchased storage equipment, including wooden pallets.

Thirty metric tons of commercial feed was purchased in two consignments and distributed to the enterprises. The first was bought from Aller Aqua, and the second from Novatek. Table 4 presents the average feed allocation across the three business models. The first consignment was allocated equally across the businesses (1170 kg), while the second was based on sales performance during the first consignment. Eventually, the businesses would order directly from the suppliers.

### Training, mentorship and coaching

The entrepreneurs were trained, mentored and coached to support them in managing their businesses profitably and reaching out to farmers with knowledge. Each enterprise was expected to train at least 42 farmers by the end of the project, and the entrepreneurs were trained and supplied with training materials written in English and local languages to facilitate the farmer training.

The coaching and mentorship activities targeted spouses co-managing the enterprises. First, they underwent a training of trainers (TOT) course

on BMPs in aquaculture so that they could offer extension services to farmers. Second, they were trained in business planning and management in which the entrepreneurs all developed business plans for their feed retail enterprises. Third, they were trained in feed handling and management, including feeding regimes, feeding practices, feed storage, and feed expiry management. Finally, five business coaching and mentorship sessions were held, covering marketing, record keeping, basic financial accounting, financial management, banking, and business sustainability approaches.

### Innovation platform

The project established an innovation platform with stakeholders in the private and public sectors—specifically the financial sector, equipment suppliers and the selected feed and seed enterprises. The platform had four objectives:

1. Determine efficient and sustainable strategies to reach smallholder farmers.
2. Facilitate dialogue among stakeholders.
3. Identify common solutions to business challenges.
4. Develop strategies to achieve common goals to improve the sector.

The innovation platform offered an avenue for addressing supply chain challenges between the feed manufacturers and enterprises, which was a huge challenge. Through the platform, the enterprises (i) connected and established working relationships among each other, (ii) set up a WhatsApp group for communication and liaison, (iii) appointed two people (a cooperative

Feed model	First consignment (kg)	Second consignment (kg)
Agro-shops	1170	1684
Cooperatives	1170	1800
Small-scale farms	1170	1603.3

**Table 4.** Average feed volumes disbursed.

chairperson and an agro-shop owner) to represent them in negotiations, (iv) connected with feed manufacturers and entered into service-level agreements and (v) made collective feed orders.

## Gender and youth inclusion

Testing the business models included men, women and youth entrepreneurs, with two cooperatives that have many women members included as enterprises. One had a female membership of 89%, while the other had a 65% majority of female youths. Agro-shops and individuals that demonstrated close collaboration between husbands and wives in managing the business were selected, three of which were co-managed by spouses. A female managed agro-shop and an agro-shop employing youth employees were also selected.

One of the criteria for selecting small-scale farm enterprises was ownership of at least five fishponds. Because of the lack of land ownership among women in the community, it was not easy to find women who owned the ponds and have the capacity to manage a feed business sustainably. Many married women managed a few ponds allocated to them by their spouses.

However, the three small-scale farms selected were co-managed by spouses.

To better incorporate women into fish farming activities, a series of aquaculture training seminars were held to foster gender-integrated business strategies. This approach sought to consider gender in all stages of development and assess the implications of any planned action on gender equity. It also included working with men to raise awareness of the crucial role of women in fish farming. The seminar participants were representatives from the enterprises that supplied fish feed and fish fingerlings to smallholder farms in the remote Northern and Luapula provinces. The training seminars focused on the role of men in fostering gender-transformative approaches, as opposed to placing the burden solely on women, to create opportunities for individuals to challenge gender norms and address power inequities actively. Researchers sought to identify and co-create strategies with participants to more meaningfully engage disenfranchised women and youths in fish farming, providing them access to productive resources and financial benefits. The enterprises targeted women with training and also collected data disaggregated by sex and age.



Photo credit: Agness Chilega/WorldFish

A female-led fish farming group in Zambia.

## 4. Performance assessment

### Financial outcomes

This section presents the financial performance of the feed businesses, capturing sales, revenues, gross margins and market reach during the first year of operations (March 2021–March 2022).

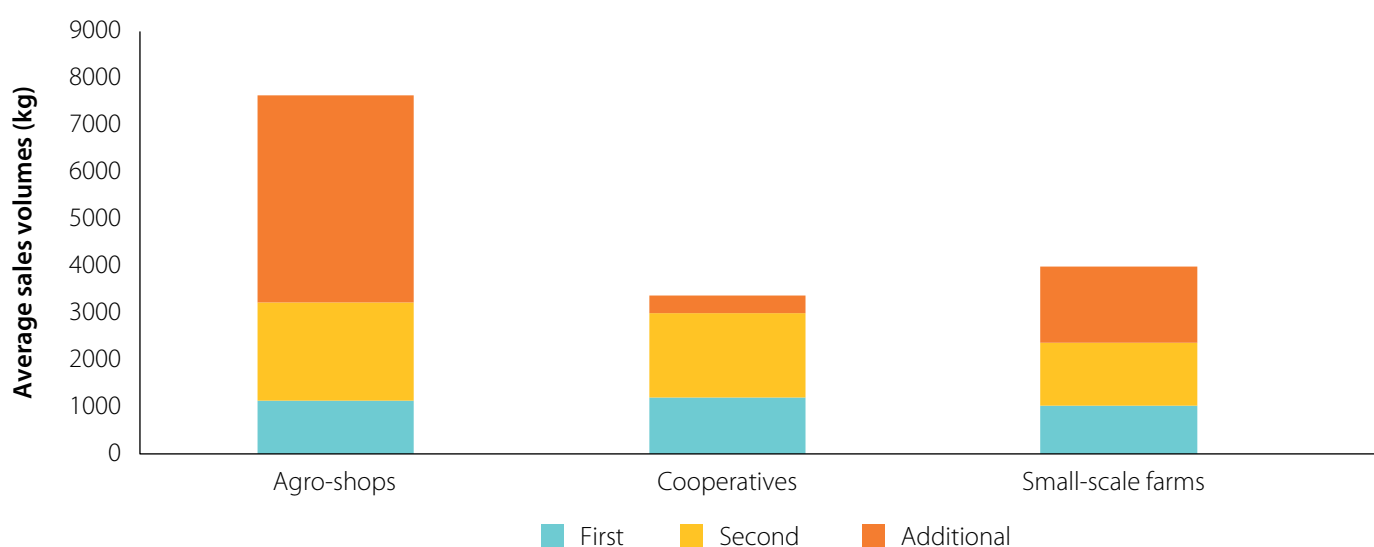
### Sales and revenues

The enterprises sold 97.8% (29.3 t) of the feed co-financed by the project. Additionally, five of the enterprises purchased 27.7 t of feed independently. Figure 2 shows the volumes sold in the first and second consignments, as well as the additional feed bought independently. On average, the agro-shops sold the highest feed

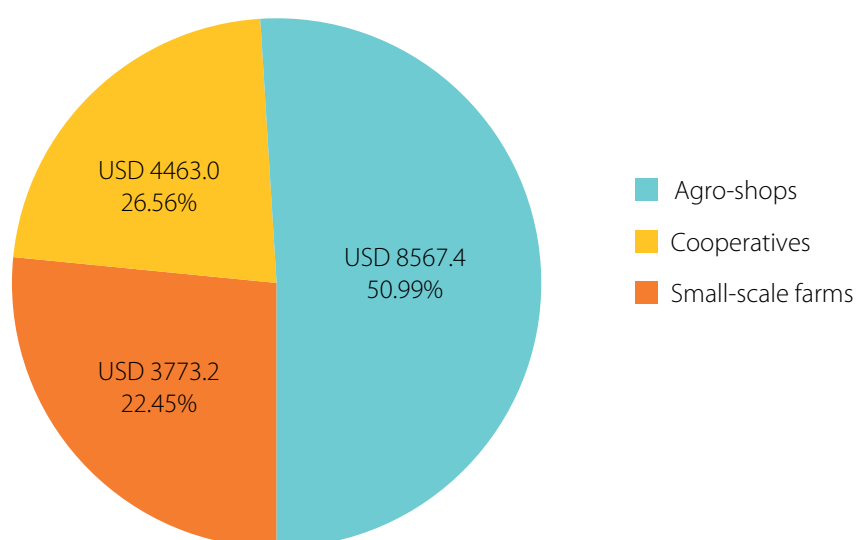
volumes (7.7 t), followed by small-scale farms (4 t) and finally cooperatives (3.4 t).

The businesses earned revenues of ZMW 1,1160,12 (USD 63,773).<sup>3</sup> Figure 3 presents the average sales revenues earned by the three business models. The agro-shops earned the highest proportion of revenues from feed sales, followed by small-scale farms and then cooperatives.

The agro-shops ordered more feed independently, increasing the revenues earned. Some small-scale farms also ordered additional feed for their own farm use and for sale.



**Figure 2.** Sales volumes across the three business models.



**Figure 3.** Sales revenues across the three business models.



## Profitability

The feed from the two consignments supplied in April and November, as well as the additional feed the businesses bought themselves, was sold at prevailing retail prices. The assessed gross margin analysis and operating profits of the business models are summarized in Table 5.

All three business models reported positive gross margins from the feed sales (Table 5), with the agro-shops presenting higher margins, followed by small-scale farms and cooperatives. The gross margin ratio is a profitability ratio that compares the gross margin of a business to the net sales. To protect farmers from high feed prices, the recommended retail prices are usually not more than a 10% margin of the purchase price. Considering transportation is a key direct cost in the feed business, the gross margin ratios for

the three business models ranged from 7.5% to 8.5%. The more an enterprise can sell feed while managing its transportation costs, the higher the gross margins earned.

Table 6 presents average overhead costs as reported by the agro-shops. While the table shows average costs, some of the agro-shops did not incur costs like rent, as they operated from their premises, and others had no hired personnel.

The cooperatives and small-scale farms reported no overhead costs, as the feed was stored and sold from the farms. To contact potential clients, cooperatives and small farms highlighted some administrative expenses related to airtime costs. However, estimating the amounts attributed to the fish feed business instead of personal use was challenging.

	Agro-shops	Small-scale farms	Cooperatives
Revenues	149,928.95	78,102.25	66,030.125
Direct costs			
Cost of goods sold	13,4591	70,112.25	59,275.125
Transportation costs	2550	1980	1800
Gross margins	127,87.95 (USD 730.74)	6010 (USD 343.43)	4955 (USD 283.14)
Gross margin ratio	8.5%	7.7%	7.5%

**Table 5.** Gross margin analysis (ZMK).

	Amount (ZMW)
Utilities (electricity)	6000
Rent	22,800
Salaries and wages	8325
Licenses	4500
Total overhead costs	41,625
20% overhead costs	8325 (USD 475.71)
Operating profit	4462.95 (USD 255.03)

**Table 6.** Overhead costs and operating profit by agro-shops.

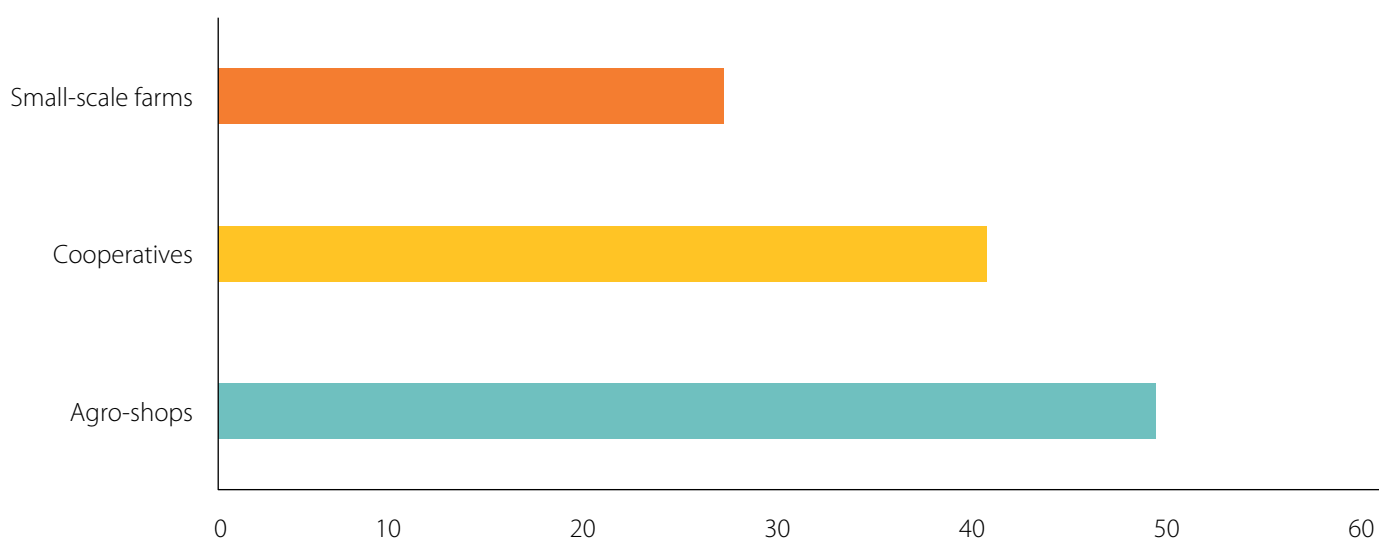
The agro-shops operated other business lines like seeds, fertilizers, farm implements, agrochemicals, other livestock feeds, fish trade, and agency banking. The period under study was the first year for the agro-shops to operate the fish feed business line. The agro-shops estimated the sale of fish feed contributed 15%–30% to their overall gross margins. On average, 20% of the overhead cost was apportioned to the fish feed business line.

### Market reach

Over the study period, the 10 enterprises sold feed to 403 clients, of whom 83.6% were males, 11% females and 5.4% farmer groups and institutions. On average, each of the enterprises sold fish feed to 40 clients.

Figure 4 presents the average number of farmers who purchased feed. On average, agro-shops sold to more farmers (~48), followed by cooperatives (~40) and small-scale farms (26). The majority of the farmers were located in the districts of operation, but some of the enterprises, especially the agro-shops, sold feed to farmers in nearby districts.

As presented in Figure 5, most of the farmers who purchased fish feed were males. The agro-shops had the highest proportion of male customers, followed by small farms, while the cooperative model reported the highest proportion of female customers compared to agro-shops and small farms. Similarly, cooperatives reported the highest proportion of institutions and farmer groups who purchased feed, while small-scale farm enterprises reported the least.



**Figure 4.** Average number of feed customers.

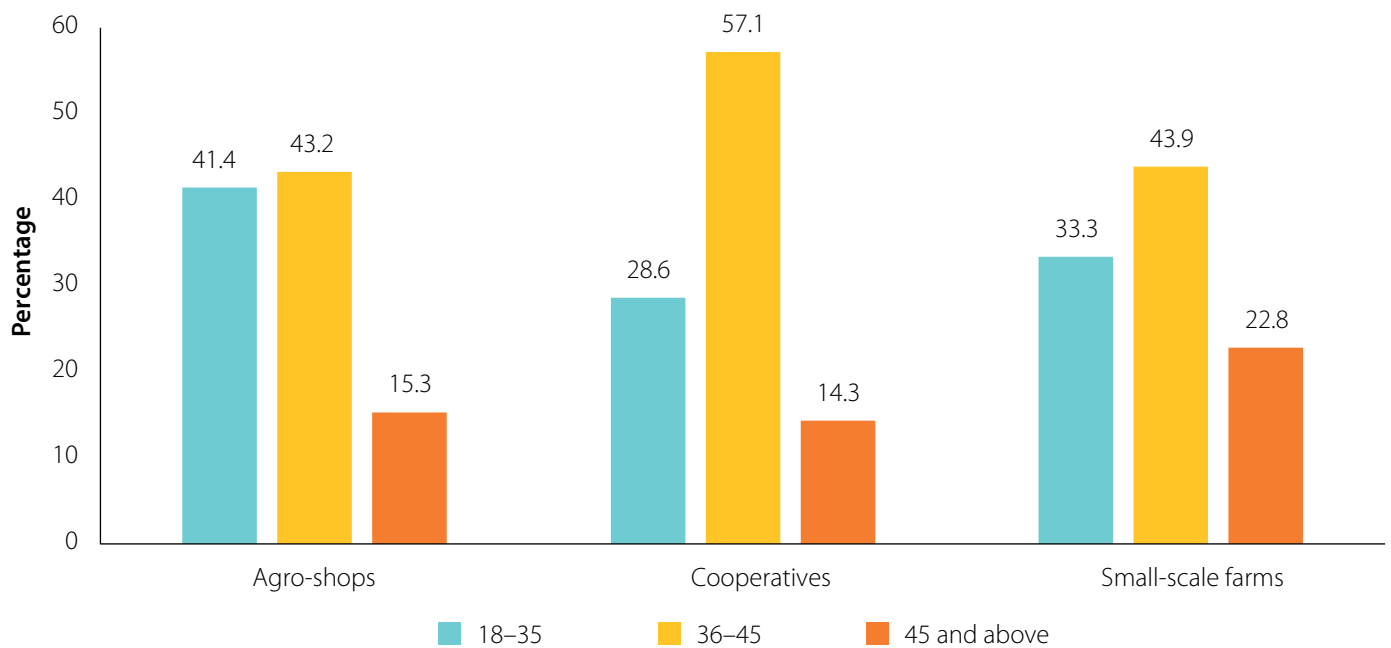


**Figure 5.** Types of fish feed customers.

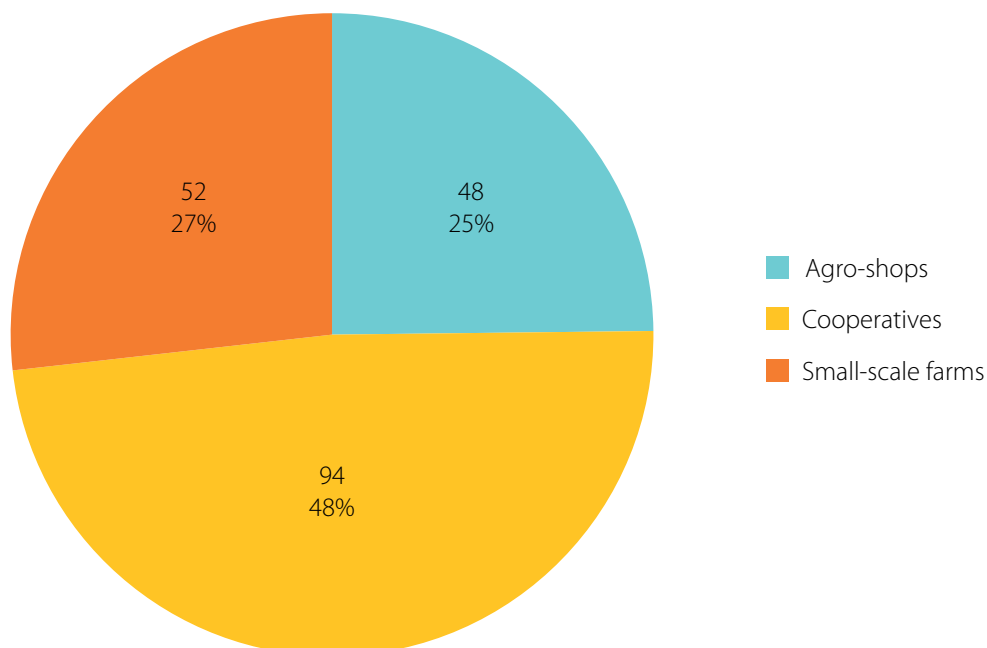
Figure 6 lists the ages of the fish feed customers. Middle-aged farmers (36–45 years old) formed the highest share of customers who purchased feed, while older farmers (45 years old and over) represented the lowest. The agro-shops sold feed to more young customers (41.4%) compared to both small farms (33.3%) and cooperatives (28.6%). However, there is a chance that some older farmers who owned ponds sent young people to buy the feed from agro-shops.

### Farmer training

As shown in Figure 7, the 10 enterprises trained 585 farmers, of whom 72.6% were males and 27.4% females. On average, each enterprise trained 59 farmers, exceeding the target of 42 per enterprise. Among the cooperatives, each trained an average of 92 farmers, representing the majority of the farmers trained, while the small-scale farm businesses trained 52 farmers each, and the agro-shops 48.



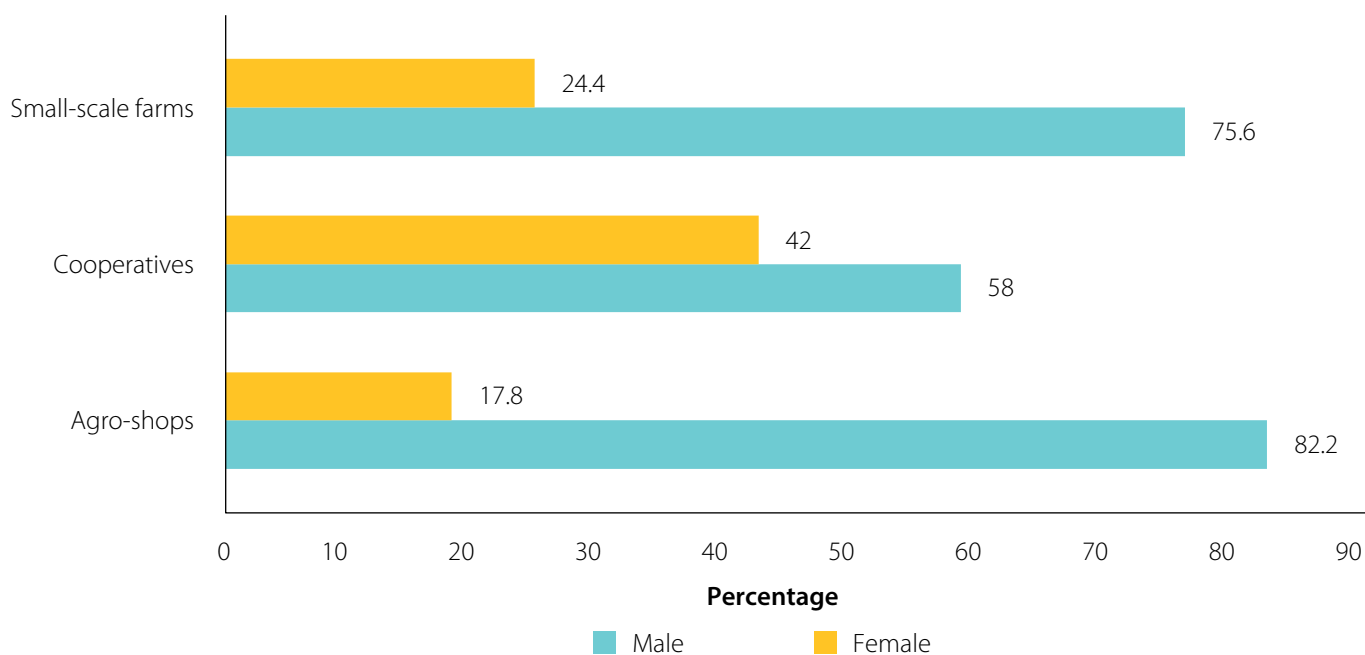
**Figure 6.** Age of fish farmers purchasing feed.



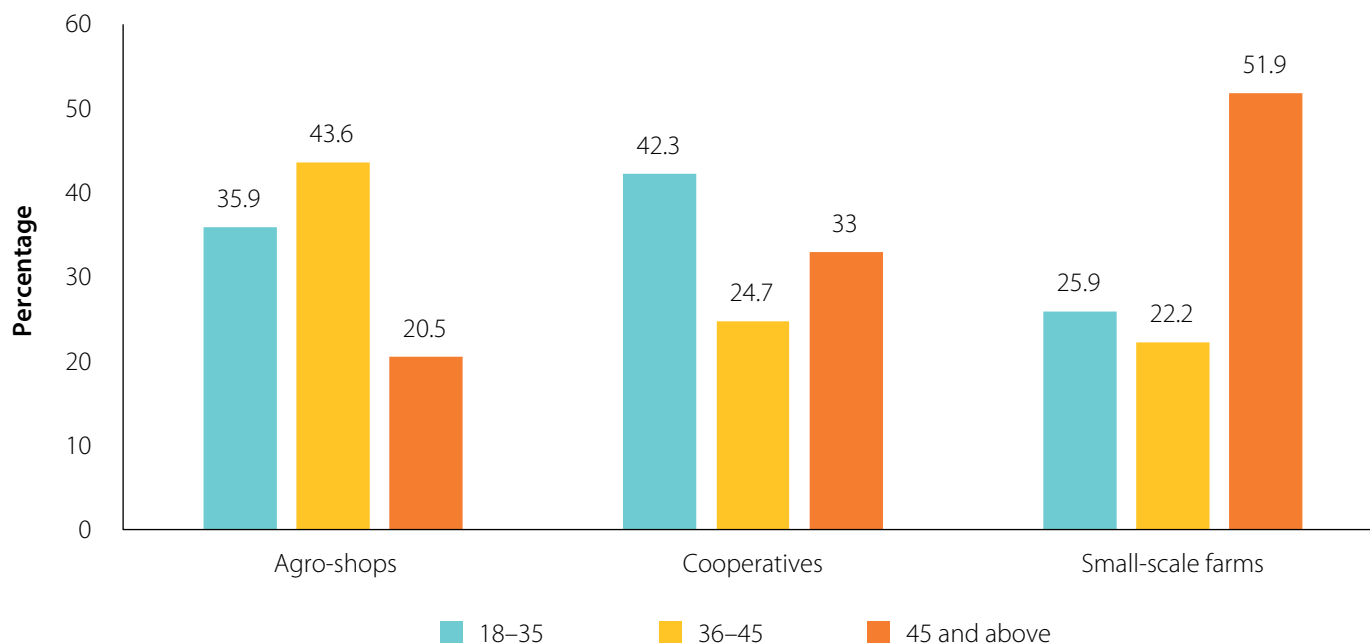
**Figure 7.** Average number and percentage of farmers trained.

Figure 8 shows the percentage of male and female farmers trained by the enterprises. Among the farmers trained by cooperatives, almost half were female, while small-scale farms trained almost a quarter. The agro-shops trained the fewest females. The cooperative model was, therefore, able to train the highest proportion of female farmers.

Figure 9 presents the proportion of farmers trained by age category across the three business models. At least 20% of all the three age categories of farmers were trained by enterprises. The agro-shops mainly trained farmers aged 35–45 (43.6%), who also formed the highest percentage of their customers. The cooperatives mainly trained younger farmers aged 18–35 (42.3%), while the small-scale farm owners trained older farmers aged 45 and older (51.9%).



**Figure 8.** Percentage of farmers trained, by gender.



**Figure 9.** Percentage of farmers trained, by age.

## 5. Discussion

---

### Market reach and financial outcomes

Overall, the agro-shops sold more feed, reached the most customers and had the highest gross margins. The agro-shops heavily depended on farmers visiting their business premises to buy feed. As a result, some customers who visited the agro-shops to buy other agricultural products might have also ended up purchasing fish feed. Some of the agro-shops mentioned advertising fish feed and other products they sold on local radio shows and social media, which attracted more customers. Notably, the agro-shops that advertised on the radio and social media reported a higher number of customers and sales volume. The agro-shops mentioned that male farmers frequently came into their shops. However, it is possible that they could have been purchasing the feed on behalf of female farmers, as men are more mobile than women.

Ownership of the business premises influenced the operating costs that the agro-shops incurred. This was not the case for cooperatives and small-scale farms that operated from their premises. Agro-shops that owned their premises had lower operating costs, making higher returns. However, the number of business lines was key to the share of overhead costs directed to the feed business. The agro-shops with more business lines easily covered their overhead costs, but they needed more coaching on financial management and accounting to assess profitability levels for each business line.

The agro-shops dealing in the fish off-take business mentioned advancing fish feed to smallholders to be paid during fish harvesting. Since the off-takers bought table-size fish from farmers and sold it, the smallholder farmers would pay the off-taker in an equivalent number of fish according to the amount of feed bought. The amount of fish used to pay for fish feed bought on credit was decided based on prevailing market prices. This strategy was helpful in targeting smallholders with low financial capacity who could not buy feed during the production period.

The small-scale farm businesses relied heavily on face-to-face interactions to target fellow farmers,

using feed on their farms and also selling it to fellow farmers. Their farms were demonstration ponds for training fish farmers and potential farmers. Owners also relied on referrals from their existing customers to target other farmers. Notably, the small-scale farms worked closely with the DOF officer in identifying and targeting farmers. The small-scale farm owners who had established good working relationships with the district fisheries officers sold more feed and targeted more farmers than farm owners who did not have such relationships with the officers.

Compared to the other models, the cooperatives sold feed to more female farmers, as the cooperatives and groups have higher proportions of women, facilitating an inclusive gender reach among them. Similarly, the cooperatives are within a network of other fish farmer groups to whom they sell feed. The success of the cooperatives also depended on the capital base and the number of enterprises each managed. A cooperative that had more enterprises and a larger capital base sold more volume and made additional feed orders.

The agro-shops and cooperatives also sold feed to institutions like schools after acquiring tax clearance. The institutional clients were beyond the reach of small-scale farms because they were not registered as companies.

### Training

Cooperatives trained more farmers than the other business models, for three reasons: (1) their membership numbers enabled them to have a wider reach, (2) their networks with other fish groups and cooperatives in the region extended their impact and influence, and (3) one cooperative hosted field days on its fish farm, attracting and reaching more farmers with on-farm training. The cooperatives also reached a higher proportion of women and youths by organizing group training for members of farmer clubs and groups, the majority of whom are youths and women. The cooperatives also offered individual training to existing fish farmers, farmers who had abandoned fish farming, and representatives of institutions, such as schools.

Small-scale farms were second in the number of farmers trained. They used five techniques to train farmers:

1. They reached out to existing and potential farmers to share information on fish farming and the benefits of using good quality fingerlings and feed for increased productivity.
2. They conducted on-farm monitoring visits to farmers who purchased fingerlings and feed.
3. They invited farmers to their fish farms for demonstrations during key activities like stocking and fish harvesting.
4. They took advantage of community meetings to share information on fish farming to farmers who had not farmed fish before and to farmers who had abandoned fish farming.

5. They organized joint training sessions, alongside the DOF officer, with fish farmers in a central location.

The agro-shops mainly offered information about feed use to customers who came to their shops. However, some agro-shops offered on-farm visits to farmers to provide training on BMPs. Offering on-farm extension visits was particularly common for agro-shops that have a dedicated staff for extension outreach, as the three agro-shops that made such visits reported higher numbers of farmers trained. Some agro-shops strategically ventured into fish farming to host demonstration ponds for the farmers while generating an additional income stream from fish farming. One agro-shop hosted a field day on its demonstration ponds, attracting fish farmers who purchased feed from its outlet.



Fish harvesting by cooperative members in Kasama District, Zambia.

## 6. Sustainability

---

### Supply chain gaps

The greatest challenge to the sustainability of the business models was access to fish feed at competitive prices because of the long distances (800–1200 km) from the manufacturers' plants in Southern and Lusaka provinces to the locations of the entrepreneurs. Transportation remains a considerable part of the cost in the feed business, so economies of scale are critical in covering these costs. A truckload of 30 t or even 15 t will generate profits when transported from a manufacturer's plant. But smaller volumes would be uneconomical.

To meet the economies of scale, the entrepreneurs opted to order feed collaboratively from the manufacturers' plants at factory prices. However, this approach faced the following challenges: (i) the entrepreneurs completed their feedstock at different times, (ii) the vast distances in between the operators increased the transportation costs, (iii) the manufacturers require payment within 7 days after the release of the quotation, which results in delays when different businesses make payments.

A second option was for entrepreneurs to buy feed through the manufacturers' feed outlets in Kasama and Mansa at distributor prices, which are lower than retail prices. The challenge here was that these outlets sell feed only at retail prices. However, through the innovation platform, negotiations with the feed manufacturers were held to give the entrepreneurs access to fish feed at distributor prices from the manufacturers' feed outlets. By April 2022, two entrepreneurs had already ordered feed at distributor prices through the outlets after signing a service-level agreement, and three others were negotiating similar agreements with the manufacturers to enable them to do so as well.

### Capital investment

To de-risk the capital investment to start the feed businesses, the project covered 70% of the cost of the two feed consignments, with each feed enterprise receiving an

estimated ZMW 42,240 (USD 2414) worth of fish feed. The capital investment will be reinvested back into the feed business line.

The agro-shops showed a higher capacity for ploughing back and reinvesting the capital gains into the feed businesses. However, poor financial record keeping revealed the potential risks of redirecting some of the funds to other business lines. To address this challenge, the entrepreneurs received business mentorship sessions on financial management and keeping financial records.

Because of their size limitations, small-scale farms faced market risks when other players entered the local market. For instance, the provision of feed through the government-sponsored program CEEC disrupted the market for one of these businesses, leading to the expiry of some feed. As such, small farms might need to expand their fish farm business to use more feed for financial resilience and market risk mitigation. Exploring new markets in nearby districts was a strategy some small-scale farms adopted to increase their sales amid possible competition.

In the cooperative model, a commitment by both leaders and members to reinvest profits back into the feed business was key for continuity. One of the cooperatives faced financial risks because it sold feed on credit to members, who had not paid it back 6 months later. This showed that selling on credit to members compromised the cooperative's ability to reorder feed independently. The second cooperative initially faced financial accounting and management challenges, but these were surmounted by business mentorship and coaching.

### Feed demand

Contrary to initial fears of nonexistent demand, the pilot project revealed a high demand for fish feed among smallholders (Mwema et al. 2021a). Most of the enterprises had sold out their feedstocks 2–4 months after stocking, with demand for even more fish feed.

Government-driven initiatives like the ZAEDP targeting aquaculture development have increased interest in aquaculture among farmers, driving up demand for fish feed. The government has started community funding through programs like the CEEC and the Community Development Fund, which farmers use to start and expand their fish farms. The increasing number of fish farmers

and the training offered by the feed enterprises are what has created the demand for fish feed. Still, there is an opportunity for the enterprises to expand their markets to nearby districts that are not served by fish feed outlets. Some enterprises have already scaled out to other districts and have targeted institutional buyers, though the potential has not been fully exploited.



Photo credit: Catherine Kwemba/KojoFish

Fish farmer feeding fish in Samfya District, Zambia.



## 7. Perception and feedback

---

We asked the feed entrepreneurs about the benefits they accrued while piloting the inclusive aquafeed business models. They highlighted the following nine benefits:

1. The startup capital co-financed by the project offered an opportunity to learn about the smallholder fish feed market, and the piloting de-risked the investment needed for learning about the market. The enterprises are now aware of the potential demand and the type of feed most demanded in any season, and they have managed to build a customer base of target farmers.

“When we started, I never thought that smallholders will be willing to buy commercial feed,” said a manager of an agro-shop in Mansa. “I was surprised when the 59 bags finished within 2 months.”

2. The TOT workshop and having access to the BMP manual allowed the enterprises to learn about aquaculture and BMPs.

“The TOT training helped me a lot,” said an agro-shop owner in Mungwi. “I even decided to start fish farming too. I have five ponds that I now use to train other farmers.”

3. Training and individual-based coaching allowed the enterprises to learn about business planning and developing business plans.

“I really liked the training method, because we wrote the business plan by ourselves, using the guided structure,” said an agro-shop owner from Luwingu. “I have used the lessons from writing this business plan to write another plan to apply for a grant.”

4. Keeping business records and accounting for revenue earned from different business units taught the enterprises how to maintain financial accounting and management.

“We now keep sales records, expenses and other business records,” said a cooperative chairperson in Kasama. “We are able to know

how much we make from the different businesses, and to also manage our expenses. It was difficult in the past. Moving forward, we won’t need to make estimations as we used to do. We have the records.”

5. The entrepreneurs received specific training on various feed products and the volumes needed for Aller Aqua and Novatek products. This allowed them to learn about the feeding regimes of the different feed types concerning the pellet sizes and crude protein content.

“One thing that was a bit hard for us before was the type of feed to use at each stage,” said a farm owner in Mungwi. “There are several types of feeds for the different stages of fish production. We now know that every feed company has different names for the feeds. The guidance from the project on which feed is to be fed to fish at what stage was good. I now have information for the Aller Aqua feed and Novatek feed.”

6. Networking and collaborating with other entrepreneurs enabled the enterprises to further the collective ordering of feed from the factory and buy from each other when they completed their feedstock.

“We have a WhatsApp group we use to communicate with each other,” said an agro-shop owner in Mansa. “Instead of your feed expiring, you can agree to give some of your feed to another shop to sell. We have also made a collaborative order to get feed from the factory.”

7. The entrepreneurs learned the importance of knowing about expiration dates for fish feed. This knowledge has helped them develop sales strategies on how much feed to buy and to sell it before it expires.

“It may look insignificant, but the expiry date is very important,” said a small-scale farm owner from Mungwi. “You know farmers even now ask about the expiry date. If you find yourself with bags that are expiring, you can really make losses.”

8. The entrepreneurs made connections with sales representatives of the feed companies with whom they can now communicate directly.

“Now we have the contacts of [sales representatives],” said an agro-shop owner from Mungwi. “We call them if we want to know the current feed prices. You know the feed prices keep changing, so one needs to know the current prices.”

9. Through the business coaching and mentorship, the entrepreneurs learned about marketing strategies and other markets, such as farmer groups and schools, that they can explore instead of depending mainly on walk-ins at their shops. Some learned about marketing strategies like advertising on radio and social media and about how to ensure that fish feed products are available at competitive prices.

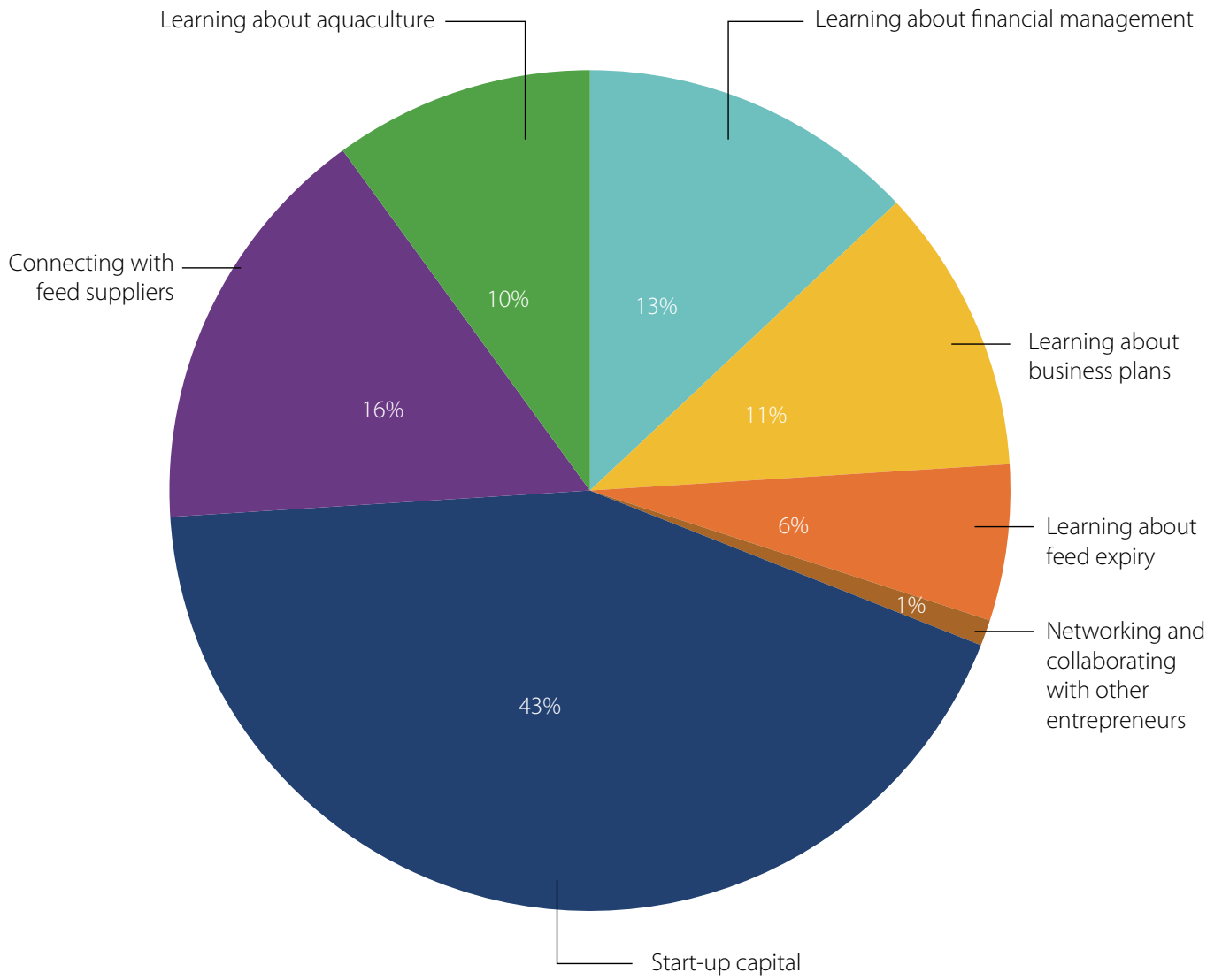
Of these nine benefits, the entrepreneurs were each asked to rank their top three from a questionnaire. The results are shown in Figures 10 and 11.

As presented in Figures 10 and 11, eight out of the 10 entrepreneurs ranked startup capital as the main benefit, followed by the ability to connect with the feed suppliers for business continuity. The entrepreneurs also considered learning about financial management, business planning and aquaculture as key benefits.

All the entrepreneurs reported that they wanted to continue with their fish feed business but noted the current challenges of volumes when ordering the feed directly from the manufacturer. The size of the market limits how much they can order at once, especially considering feed expiry dates. However, they do see opportunities to target fish farmers in other areas beyond their districts and schools in order to expand their market base. The smallholder fish farmer population is growing, which implies increased demand and business opportunities.



**Figure 10.** Entrepreneurs’ ranking of their top-three key benefits.



**Figure 11.** Weighted scores for the three key benefits.

## 8. Lessons and recommendations

---

This report shares experiences and outcomes in piloting three inclusive aquafeed business models in Zambia. The report highlighted the design, financial outcomes, market reach, farmers' training, sustainability and perception of the benefits by the entrepreneurs.

All three business models were profitable. The agro-shops achieved higher gross margins because of higher sales, while the cooperatives were more gender and youth inclusive in member composition and farmers trained. Some of the critical lessons learned from the pilot include the following:

### **1. Constant engagement with private sector players is critical in developing inclusive business models.**

Initially, it was challenging to maintain a continuous feed supply to the enterprises. The minimum amount required to order directly from the manufacturers, while still returning a profit, were beyond the financial capacity of the enterprises. There was also the added risk of the feed expiring before they managed to sell all their stock. Through the project's innovation platform, the feed operators opted to order collectively from the manufacturers at factory prices. Further engagement with the manufacturers led them to negotiate service-level agreements that would allow them to buy feed from the outlets in Kasama and Mansa at distributor prices.

### **2. The training material needs to be simpler.**

The technical materials from the feed manufacturers were too complex for small-scale entrepreneurs and farmers to understand. The feed companies need to consider simplifying the material and having simplified brochures in local languages. Also, the names and categories of feeds and categorization are inconsistent across the manufacturers. To solve this problem, the project team simplified the feeding tables before dissemination and offered technical guidance for the different feed types that the two manufacturers supplied. The BMP manual that the entrepreneurs used to train farmers was simplified and translated into the local language by the project before dissemination to farmers.

### **3. Public investments need to be leveraged.**

The government has initiated some programs to support aquaculture development that could either strengthen or disrupt the fish feed market. For instance, one of the small farms faced market challenges because of excess feed distributed in the region through the CEEC loan program, affecting its sales in the first half of the year. Another entrepreneur leveraged the same programs to become a feed supplier through the CEEC.

### **4. Business mentorship and coaching are key for sustainable business operations.**

Mentorship and coaching improved the feed entrepreneurs' record keeping, business planning and financial management. The mentorship must transcend the fish feed business to other business lines to facilitate holistic and sustainable enterprise management. Initially, mentorship only covered the feed business, but later other business lines were integrated. A business coaching and mentoring partner could be incorporated into future work to strengthen and maximize the potential of business coaching.

### **5. Partnership with the DOF improved business returns and capacity building.**

Some enterprises benefitted immensely from working with the DOF officers, who directed them to fish farmers, helping them build a customer base. Entrepreneurs working with the officers generated business returns by reaching more farmers and leveraging technical capacity building.

### **6. Exploring market strategies promotes inclusion and sustainability.**

Marketing approaches targeting women and youths, such as farmer group training and hosting field days, fostered inclusion and increased sales. The fish off-takers advanced feed to smallholders and recovered the cost when buying fish from the farmers. This approach helped include smallholders who could not afford to buy feed during the production period.

## 7. Incorporating financing mechanisms and financial products is attractive to entrepreneurs.

Future research should incorporate a financing mechanism to build up the financial abilities of small businesses. The project's innovation platform should offer financial sector players an opportunity to work with the enterprises. However, initial discussions point to the fact that the products that the sector currently offers in the market are not suitable for small-scale enterprises. Instead, the sector could

develop customized financial products that target small-scale enterprises and farmers.

In conclusion, this paper has shed light on the outcomes of piloting inclusive aquafeed business models through a pilot of 10 business cases. Key lessons generated from this pilot can be integrated into other initiatives to develop other inclusive business models for underserved groups in Zambia, as well as other African countries. These models can be scaled up to facilitate large-scale assessment and amplify the impact of this pilot.



Photo credit: Catherine Mwenemwa/WorlDfish

Mentoring session with an agro-shop staff in Mansa District, Zambia.

# Notes

---

- <sup>1</sup> One additional agro-shop was recruited during the second cycle to reach farmers in an underserved district.
- <sup>2</sup> The fish feed outlets were only located in Mansa and Kasama, the respective provincial headquarters of Luapula and Northern provinces.
- <sup>3</sup> We used the average exchange rate during the piloting of the business models: USD 1 = ZMW 17.5.

# References

---

Barrett CB, Bachke ME, Bellemare MF, Michelson, HC, Narayanan S and Walker TF. 2012. Smallholder participation in contract farming: Comparative evidence from five countries. *World Development* 40(4):715–30. doi: [10.1016/j.worlddev.2011.09.006](https://doi.org/10.1016/j.worlddev.2011.09.006)

[DOF] Department of Fisheries. 2018. Department of Fisheries 2017 annual report. Chilanga, Zambia: Government of Zambia.

El-Sayed MA, Dickson WM and El-Naggar OG. 2014. Value chain analysis of the aquaculture feed sector in Egypt. *Aquaculture* 437:92–101.

[FAO] Food and Agriculture Organization. 2015. Inclusive business models: Guidelines for improving linkages between producer groups and buyers of agricultural produce. Rome: FAO.

[FAO] Food and Agriculture Organization. 2017. Social and economic performance of tilapia farming in Africa. FAO Fisheries and Aquaculture Circular No.1130. Rome: FAO.

[FAO] Food and Agriculture Organization. 2020. State of world fisheries and aquaculture. Rome: FAO.

[GIZ] Gesellschaft für Internationale Zusammenarbeit. 2013a. Contract farming handbook. Bonn, Germany: GIZ.

[GIZ] Gesellschaft für Internationale Zusammenarbeit. 2013b. Inclusive business models: Options for support through PSD programmes. GIZ on behalf of BMZ. Bonn, Germany: GIZ.

Ha TTT, Bush SR and Van Dijk H. 2013. The cluster panacea: Questioning the role of cooperative shrimp aquaculture in Vietnam. *Aquaculture* 388:89–98.

Hyuha TS, Ekere W, Egna H and Molnar JJ. 2017. Social and economic performance of tilapia farming in Uganda. In Cai J, Quagrainie KK and Hishamunda N, eds. Social and economic performance of tilapia farming in Africa. FAO Fisheries and Aquaculture Circular No. 1130. Rome: FAO. 127–44.

Kaminski AM, Genschick S, Kefi AS and Kruijssen F. 2018. Commercialization and upgrading in the aquaculture value chain in Zambia. *Aquaculture*. doi: [10.1016/j.aquaculture.2017.12.010](https://doi.org/10.1016/j.aquaculture.2017.12.010)

Krishnan SB and Peterburs T. 2017. Jobs in value chains, Zambia. Washington, DC: International Bank for Reconstruction and Development/World Bank.

- Lundebe M, Cole SM, Mekkawy W, Yossa R, Basiita RK, Nyirenda M, Muyuni N and Benzie JAH. 2022. On-farm participatory evaluation of feeding approaches used by farmers for tilapia (*Oreochromis macrochir*) production in northern Zambia. *Aquaculture* 549:737747. doi: [10.1016/j.aquaculture.2021.737747](https://doi.org/10.1016/j.aquaculture.2021.737747)
- Mamun-Ur-Rashid M, Belton B, Phillips M and Rosentrater KA. 2013. Improving aquaculture feed in Bangladesh: From feed ingredients to farmer profit to safe consumption. Penang, Malaysia: WorldFish. Working Paper: 2013-34.
- Mudege NN and Mwema C. 2020. Stakeholder workshop report: Piloting inclusive business and entrepreneurial models for smallholder farmers and poor value chain actors in Zambia. Penang, Malaysia: WorldFish. Workshop Report. <https://hdl.handle.net/20.500.12348/4624>
- Munguti JM, Musa S, Orina PS, Kyule DN, Opiyo MA, Charo-Karisa H and Ogello EO. 2014. An overview of the current status of Kenyan fish feed industry and feed management practices, challenges and opportunities. *International Journal of Fisheries and Aquatic Studies* 1(6):128–37.
- Murekezi P, Menezes A and Ridler N. 2018. Contract farming and public-private partnerships in aquaculture: Lessons learned from East African countries. FAO Fisheries and Aquaculture Technical Paper No. 623. Rome: FAO.
- Mwema CM, Mudege NN, Lundebe M, Nankwenya B, Kakwasha K, Phiri M, Basiita RK and Siamudaala V. 2021a. A review of aquafeed business models and the feed value chain in Zambia and Malawi. Penang, Malaysia: WorldFish. Program Report: 2021-08. <https://hdl.handle.net/20.500.12348/4724>
- Mwema CM and Crewett W. 2019. Institutional analysis of rules governing trade in African leafy vegetables and Implications for smallholder inclusion: Case of schools and restaurants in rural Kenya. *Journal of Rural Studies* 67:142–51. doi: [10.1016/j.jrurstud.2019.02.004](https://doi.org/10.1016/j.jrurstud.2019.02.004)
- Mwema CM, Mudege NN and Shikuku KS. 2021b. Scoping study of aquafeed business models in Central Kenya. Penang, Malaysia: WorldFish. <https://hdl.handle.net/20.500.12348/4529>
- Obwanga B and Lewo MR. 2017. From aid to responsible trade: Driving competitive aquaculture sector development in Kenya: Quick scan of robustness, reliability and resilience of the aquaculture sector. Report 2017-092 3R Kenya. Wageningen, Netherlands: Wageningen University & Research.
- Orr A and Mwema C. 2013. Inclusive business models for sorghum and millets: Three case studies in East Africa. International Crops Research Institute for the Semi-Arid Tropics, Socioeconomics Discussion Paper 5. Nairobi, Kenya: ICRISAT. <http://oar.icrisat.org/6993/>
- Orr A, Mwema C and Mulinge W. 2014. The value chain for sorghum beer in Kenya. International Crops Research Institute for the Semi-Arid Tropics, Socio economics discussion paper 16. Nairobi, Kenya: ICRISAT. [http://oar.icrisat.org/7840/1/SDPS\\_16.pdf](http://oar.icrisat.org/7840/1/SDPS_16.pdf)
- Sankaran S, Dick B, Passfield R and Swepson P, eds. 2001. *Effective Change Management Using Action Learning and Action Research: Concepts, Frameworks, Processes, Applications*. Lismore, Australia: Southern Cross University Press.
- Shani AB and Coghlan D. 2021. Action research in business and management: A reflective review. *Action Research* 19(3):518–41. doi: [10.1177/1476750319852147](https://doi.org/10.1177/1476750319852147)
- Tran N, Chub L, Chana YC, Genschick S, Phillips JM and Kefi SA. 2019. Fish supply and demand for food security in Sub-Saharan Africa: An analysis of the Zambian fish sector. *Marine Policy* 99:343–50.
- Vorley B, Lundy M and MacGregor J. 2009. Business models that are inclusive of small farmers. In da Silva CA, Baker D, Shepherd AW and Jenane C, eds. *Agro-industries for Development*. Rome: FAO; Vienna: UNIDO; Cambridge: CABI.

## List of figures

---

<b>Figure 1.</b> Steps in the design and selection of the business models.	8
<b>Figure 2.</b> Sales volumes across the three business models.	13
<b>Figure 3.</b> Sales revenues across the three business models.	13
<b>Figure 4.</b> Average number of feed customers.	15
<b>Figure 5.</b> Types of fish feed customers.	15
<b>Figure 6.</b> Age of fish farmers purchasing feed.	16
<b>Figure 7.</b> Average number and percentage of farmers trained.	16
<b>Figure 8.</b> Percentage of farmers trained, by gender.	17
<b>Figure 9.</b> Percentage of farmers trained, by age.	17
<b>Figure 10.</b> Entrepreneurs' ranking of their top-three key benefits.	23
<b>Figure 11.</b> Weighted scores for the three key benefits.	24

## List of tables

---

<b>Table 1.</b> Typical organization of smallholder production.	5
<b>Table 2.</b> Data sources used in the study.	7
<b>Table 3.</b> Description of the business models and business cases piloted.	9
<b>Table 4.</b> Average feed volumes disbursed.	11
<b>Table 5.</b> Gross margin analysis (ZMK).	14



# Annex 1. Assessment tool for feed operators

---

## 1. General information

1. Category:  
(i) SME (ii) individual farmer (iii) cooperative
2. Name: \_\_\_\_\_
3. Sex of the owner(s) or individual(s):  
(i) male (ii) female (iii) male and female
4. Age of owner(s) or individual(s):  
(i) under 25 (ii) 25–35 (iii) 35–45 (iv) over 45
5. Who manages the business? What is their relationship to the owner?  
(i) owner (ii) spouse (iii) owner and spouse (iv) son (v) daughter (vi) employee
6. How many people in total are engaged in the business/cooperative, including females, males and youths (under 35)?
7. Location: \_\_\_\_\_
8. Contact: \_\_\_\_\_
9. Years in operation: \_\_\_\_\_
10. What is the main product sold or the activities you engage in (individual or cooperative)?  
\_\_\_\_\_
11. Do you sell any type of feeds?  
\_\_\_\_\_

## 2. Willingness and interest to engage as an IBEM

(Ask all respondents)

1. Would you be willing and interested to sell fish feeds?
  - i. If yes, why haven't you started selling fish feeds?
  - ii. If no, why?
2. Would you be willing and available to be trained in fish farming, business development and fish feed handling? What constraints do you foresee?  
\_\_\_\_\_
3. Would you be willing to engage in training farmers on fish farming and the use of commercial feeds? What constraints or challenges do you foresee if you are to engage in training a cluster of farmers who would also be your customers?  
\_\_\_\_\_
4. What method of training farmers would you most prefer to use?  
\_\_\_\_\_

5. Would you be ready to invest some proportion of capital in purchasing the first batch of fish feeds to sell to farmers? If yes, how much, or what percentage of the feed cost would you be able to invest? (work with 1 t, which is approximately ZMK 15,000 total cost)  
\_\_\_\_\_
6. Would you be interested in combining your purchases and buying feeds in bulk as members? What challenges do you foresee? (to be asked to cooperatives only)  
\_\_\_\_\_
7. Do you have a store or space where you can keep the feed to be sold?  
\_\_\_\_\_
8. Generally, as a business or cooperative, what are the key constraints or challenges you face?  
\_\_\_\_\_
9. What strengths do you have as a business, individual or cooperative to enable you to venture into the feed business?  
\_\_\_\_\_

### **3. Working approach with farmers**

(Focus on the main feed product) Who are your feed buyers? (individual farmers, cooperatives, organizations, agro-shops, etc.)

1. Do you usually sell feeds on credit? What are the terms?  
\_\_\_\_\_
2. Do you have a minimum volume that you transport or deliver? What are the terms and arrangements for delivery?  
\_\_\_\_\_
3. In a day, approximately how many feed buyers do you sell to?  
\_\_\_\_\_
4. What are the average volumes that farmers purchase per transaction?  
\_\_\_\_\_
5. What challenges do you face selling feeds to farmers?  
\_\_\_\_\_

### **4. Feedstock**

1. Where do you buy feeds from? (feed company, feed agent or distributor, agro-dealers or agro-shops, etc.)  
\_\_\_\_\_
2. Do they transport or deliver to you? What are the terms of delivery?  
\_\_\_\_\_
3. If not, what is the transportation cost you incur?  
\_\_\_\_\_
4. How frequently do you restock feeds?  
\_\_\_\_\_
5. What are the average volumes of feed you sell in a month or week? (average sales volume in a period)  
What are the challenges in restocking feeds?  
\_\_\_\_\_



## **About WorldFish**

WorldFish is an international, not-for-profit research organization that works to reduce hunger and poverty by improving aquatic food systems, including fisheries and aquaculture. It collaborates with numerous international, regional and national partners to deliver transformational impacts to millions of people who depend on fish for food, nutrition and income in the developing world.

The WorldFish headquarters is in Penang, Malaysia, with regional offices across Africa, Asia and the Pacific. The organization is a member of CGIAR, the world's largest research partnership for a food secure future dedicated to reducing poverty, enhancing food and nutrition security and improving natural resources.

For more information, please visit [www.worldfishcenter.org](http://www.worldfishcenter.org)